**Particle Theory and Classification of Matter (2016)**

There are five important concepts about the particles that make up all matter.

1. All matter is made up of extremely \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Each \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ substance has its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, different from particles of other pure substances. The atom of every **element** named on the periodic table is a particle of matter.
3. There is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between particles.
4. Particles are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Particles at \_\_\_\_\_\_\_\_\_\_\_\_\_\_ temperatures \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on average than particles at a lower temperature.
5. Particles \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ each other.

**Classification of Matter**

The two main categories of matter are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Each of these categories is broken into two smaller groups as shown.

**1. Elements**

**Elements** are pure substances containing only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Always found on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Examples: **hydrogen, helium,** \_\_\_\_\_\_\_\_\_\_\_ , \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2. Compounds or Molecules**

**Molecules** are pure substances containing two or more different kinds of atoms chemically bonded together. They are also known as **compounds**. They are recognized by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Examples: 🡪 water \_\_\_\_\_\_\_\_\_\_\_ 🡪 carbon dioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3. Homogeneous Mixtures or Solutions**

Homogeneous mixtures look the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. There is only one visible part or \_\_\_\_\_\_\_\_.

Examples: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, coke, fruit punch; What’s in milk? Water, calcium, lactose sugar and protein. But we see \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4. Heterogeneous Mixtures**

Heterogeneous mixtures have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Examples: sand + water, oil + water, layer cake, deluxe pizza

**Classify each of the following examples:**

1. A chocolate chip cookie is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Iron is a pure substance, an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Caffeine is a pure substance, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Vanilla ice cream is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Classwork**

1. Read Nelson p 44-47

2. Draw diagrams to explain the difference between (a) a pure substance and a mixture, and (b) a solution and a heterogeneous mixture

3. Give examples of two molecules that are made from the same types of atoms

4. State whether each of the following pure substances is an element or a compound. Explain your reasoning.

|  |  |
| --- | --- |
| (a) A clear colourless liquid that can be split into two gases with different properties. |  |
| (b) A yellow solid that always has the same properties and cannot be broken down. |  |
| (c) A colourless gas that burns to produce carbon dioxide and water. |  |

5. Explain what’s wrong with the colours in Fig 1 on p 45? See the top left of the diagram, think, look!

**Particle Theory and Classification of Matter (2016)**

There are five important concepts about the particles that make up all matter.

1. All matter is made up of extremely tiny particles.
2. Each pure substance has its own kind of particle, different from particles of other pure substances. Every **element** named on the periodic table is a particle of matter.
3. There is a lot of space between particles.
4. Particles are always moving. Particles at higher temperatures move faster on average than particles at a lower temperature.
5. Particles attract each other.

**Classification of Matter**

The two main categories of matter are pure substances and mixtures. Each of these categories is broken into two smaller groups as shown.

**1. Elements**

Elements are pure substances containing only one type of atom. Always found on the periodic table.

Examples: hydrogen, helium, sodium, carbon

**2. Compounds or Molecules**

Molecules are pure substances containing two or more different kinds of atoms chemically bonded together. They are also known as compounds. They are recognized by a chemical formula.

Examples: 🡪 water (H2O), 🡪 carbon dioxide (CO2)

**3. Homogeneous Mixtures or Solutions**

Homogeneous mixtures look the same throughout. There is only one visible part or **phase.**

Examples: milk, coke, fruit punch; What’s in milk? Water, calcium, lactose sugar and protein. But we see only 1 phase.

**4. Heterogeneous Mixtures**

Heterogeneous mixtures have two or more different phases. Examples: sand + water, oil + water, layer cake, deluxe pizza

**Classify each of the following examples:**

1. A chocolate chip cookie is a heterogeneous mixture.

2. Iron is a pure substance, an element.

3. Caffeine is a pure substance, a compound.

4. Vanilla ice cream is a homogeneous mixture.

**Classwork**

1. Read Nelson p 44-47

2. Draw diagrams to explain the difference between (a) a pure substance and a mixture, and (b) a solution and a heterogeneous mixture

3. Give examples of two molecules that are made from the same types of atoms

4. State whether each of the following pure substances is an element or a compound. Explain your reasoning.

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| (a) A clear colourless liquid that can be split into two gases with different properties. |  |
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| (c) A colourless gas that burns to produce carbon dioxide and water. |  |

5. Explain what’s wrong with the colours in Fig 1 on p 45? See the top left of the diagram, think, look!

**Using the Particle Theory of Matter - Homework**

1. Read Nelson p 44

2. Complete this table comparing water particles in the three different states of matter.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **ICE** | **WATER** | **VAPOUR** |
| **Temperature** |  |  |  |
| **Water Particle Motion** |  |  |  |
| **Water Particle Spacing** |  |  |  |
| **Water Particle Attractive Forces between particles** |  |  |  |
| **Water Particle Size** |  |  |  |

3. Mark each statement as True or False.

If a statement is false, change it to be true by replacing a word or phrase.

\_\_\_\_\_ In a gas, the particles have the least attraction for each other.

\_\_\_\_\_ Solid is the state of matter where the particles are closest together.

\_\_\_\_\_ Matter expands when heated because the particles get larger in size.

\_\_\_\_\_ The Particle Theory of Matter states that as the temperature increases, the spaces between the particles gets larger.

\_\_\_\_\_ There is no space between particles in a solid.

\_\_\_\_\_ The particles in ice are moving faster than the particles in water.

\_\_\_\_\_ The particles in liquid water are larger than the particles in water vapour.

\_\_\_\_\_ When energy is added, the particles move more rapidly.

**ANSWERS - Using the Particle Theory of Matter - Homework**

1. Read Nelson (2000) p 44

2. Complete this table comparing water particles in the three different states of matter.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **ICE** | **WATER** | **VAPOUR** |
| **Temperature** | LOW | MEDIUM | HIGH |
| **Water Particle Motion** | MOVING SLOWLY | MOVING MODERATELY | MOVING RAPIDLY |
| **Water Particle Spacing** | CLOSE TOGETHER PARTICLES BUT STILL LOTS OF SPACE BETWEEN | SOME SPACE BETWEEN PARTICLES | PARTICLES ARE VERY FAR APART |
| **Water Particle Attractive Forces between particles** | STRONG ATTRACTIVE FORCES HOLDING PARTICLES TOGETHER | PARTICLES ARE ATTRACTED TO EACH OTHER | WEAK ATTRACTIVE FORCES BETWEEN PARTICLES |
| **Water Particle Size** | SAME SIZE | SAME SIZE | SAME SIZE |

3. Mark each statement as True or False.

If a statement is false change it to be true by replacing a word or phrase.

\_\_**T**\_\_\_ In a gas, the particles have the least attraction for each other.

\_\_**T**\_\_\_ Solid is the state of matter where the particles are closest together.

\_\_**F**\_\_\_ Matter expands when heated because the particles get ~~larger in size.~~ **FURTHER APART**

\_\_**T**\_\_\_ The Particle Theory of Matter states that as the temperature increases, the spaces between the particles gets larger.

\_\_**F**\_\_\_ There is ~~no~~ space between particles in a solid.

\_\_**F**\_\_\_ The particles in ice are moving ~~faster~~ **SLOWER** than the particles in water.

\_\_**F**\_\_\_ The particles in liquid water are ~~larger~~ ~~than~~ **THE SAME SIZE AS** the particles in water vapour.

\_\_**T**\_\_\_ When energy is added, the particles move more rapidly.